FISH BEHAVIOR

All fishing practices depend upon some knowledge of the behavior of the particular species being sought. This knowledge is now mainly a collection of observations of fishermen and naturalists over the centuries. It is long past time that a serious quantitative investigation be made of the factors which influence aggregation, vertical distribution, seasonal migration, feeding cycles, changes in availability, escape from gear, and other aspects of the behavior of fishes.

August 6, 1959

SUMMARY CO OL SCHEDULE

Investigation: **Fish Behavior**
Biological Laboratory: Woods Hole, Mass.

Project Title	Est.* Cost	57	58	59	60	61	62	63	64	65	66
		Fiscal Years									
1. Film - Groundfish in otter trawls	40.2	16.2	24.0	-	-	-	-	-	-	-	-
2. Behavior of groundfish in otter trawls	23.6	-	-	12.2	11.4	-	-	-	-	-	-
3. Depth-temperature recorder	21.8	-	-	10.3	11.5	-	-	-	-	-	-
4. Orientation of bottom fish to current and light	110.4	-	-	-	-	8.0	9.2	13.3	39.7	40.2	-
5. Diurnal migrations of scup and butterfish	30.7	-	-	-	-	8.1	9.4	13.2	-	-	-
6. Development of techniques for study of swim. ability	30.4	-	-	-	-	8.0	9.2	13.2	-	-	-
Investigation Total	257.1	16.2	24.0	22.5	22.9	24.1	27.8	39.7	39.7	40.2	-

Annual Review

Laboratory	Regional or Area Office	Washington Office

		Date
Prepared by:	Robert Livingstone	8/6/59
Recommended by:		Date
Lab. Director	Herbert W. Graham	8/6/59
Reg. or Area Dir.	[illegible]	
Branch Chief	[illegible]	12-24-59
Approved by:	[illegible]	
	Division Chief for Director	

*Total needed by Laboratory for Project in thousands of dollars.

#714 7/9/59

U. S. Fish and Wildlife Service
Bureau of Commercial Fisheries

Sheet No. 1

Location: Woods Hole, Mass.
Date: August 6, 1959
File No.

Research Project Outline

Title of Project: The behavior of groundfish in the cod end of otter trawls.

Investigation Title: Fish Behavior

Investigation Chief: R. Livingstone, Jr.

Project Leader: R. Livingstone, Jr., Fishery Research Biologist GS-9
Name Title Grade

Assistants: (Title and Grade)

Collaborators:

Need for Information: Gear selection experiments have shown differential escapement for different sizes of fish. From variations in these escapement experiments it is plain that escapement is not an active directed behavior. Observations are needed as to the mechanism of escape.

Objective: To determine the factors effecting the escapement of different species of groundfish.

Method of Procedure: UWTV in cod end. Observe reactions of fish to towing speed, size of catch, species composition, etc. Completed.
Phase 1: To analyze films of monitor, record and describe behavior.

Phase 2:

Fish Behavior - 2

Sheet No. 2 File No.:

Method of Procedure: (Cont'd)

Phase 3:

Estimated Costs: Total Needed by Laboratory for Complete Project 23.6

	FY 1959	FY 1960	FY 1961
Personal Services	3.8	2.8	--
Other Expenses:			
Within Project	0.3	0.1	--
Lab. Adm. & Ser.	8.1	8.5	--
Lab. Total	12.2	11.4	--
Regional Office	.122	.114	
Washington Office			
Total			

Recommended Source of Funds **S-K and Regular**
(S-K, Regular, Contributed, etc.)

Estimated Date of Completion: Phase 1 FY ; Phase 2 FY ; Phase 3 FY ; Project FY 60

Recommended by: Date

Originator **R. L. Livingstone, Jr.** 8/6/59

Investigation Chief Robert Livingstone, Jr. 8/6/59

Laboratory Director Herbert W. Graham 8/6/59

Regional Director Joseph F. Puncochar 8/19/59

Branch Chief HHE. 12-24-59

Approved by:

Division Chief for Director [illegible]

Remarks

(Continue on reverse side)

#715 7/9/59

U. S. Fish and Wildlife Service
Bureau of Commercial Fisheries

Sheet No. 1

Location: Woods Hole, Mass.
Date: August 6, 1959
File No.

Research Project Outline

Title of Project: Depth-temperature for use with underwater television systems.

Investigation Title: Fish Behavior

Investigation Chief: R. Livingstone, Jr.

Project Leader: R. Livingstone, Jr. Fishery Research Biologist GS-9
Name Title Grade

Assistants: (Title and Grade)

Collaborators:

Need for Information: In order to evaluate the activities of fish in a trawl net or in the environment, it is necessary to consider temperatures, depths, currents, etc. Instrumentation needed to be developed for measuring these variables in conjunction with visual TV observations, the usefulness of UTV would be greatly increased.

Objective: To develop instruments for measuring temperature, depth, current, etc., in conjunction with UTV observations.

Method of Procedure:

Phase 1: To present the idea to WHOI and enlist their services to design and fabricate a single conductor telemeter that would transmit temperature and depth information through the television cable.

Phase 2: Test under field conditions.

Fish Behavior - 3

Sheet No. 2 File No.:

Method of Procedure: (Cont'd)

Phase 3:

Estimated Costs: Total Needed by Laboratory for Complete Project 21.8

	FY 1959	FY 1960	FY 1961
Personal Services	2.0	2.8	--
Other Expenses: Within Project	0.2	0.1	--
Lab. Adm. & Ser.	8.1	8.6	--
Lab. Total	10.3	11.5	--
Regional Office	.103	.115	
Washington Office			
Total			

Recommended Source of Funds S-K and Regular
(S-K, Regular, Contributed, etc.)

Estimated Date of Completion: Phase 1 FY 59; Phase 2 FY ; Phase 3 FY ; Project FY 60

Recommended by:

		Date
Originator	R. L. Livingstone, Jr	8/6/59
Investigation Chief	Robert Livingstone, Jr.	8/6/59
Laboratory Director	Herbert W. Graham	8/6/59
Regional Director	Joseph F. Pomeroy	8/19/59
Branch Chief	[illegible]	12-24-59

Approved by:

Division Chief for Director [illegible]

Remarks

(Continue on reverse side)

#715 7/9/59

U. S. Fish and Wildlife Service
Bureau of Commercial Fisheries

Sheet No. 1

Location: Woods Hole, Mass.
Date: August 6, 1959
File No.

Research Project Outline

Title of Project: Orientation of bottom fish with reference to a current and light.

Investigation Title: Fish Behavior

Investigation Chief: R. Livingstone, Jr.

Project Leader: R. Livingstone, Jr. Fishery Research Biologist GS-9
Name Title Grade

Assistants: (Title and Grade)

Collaborators:

Need for Information: Many species of groundfish have been observed to orient upstream in the cod end of otter trawls. If facing into the current is common also in nature, then one would expect wide variations in the catch of groundfish in short intervals of space and time. Observations on orientations to a current are necessary in order to understand this behavior and more fully appreciate efficiency of gear.

Objective: To determine if bottomfish orient with reference to tidal and other currents, light, etc.

Method of Procedure: Observations of behavior and orientation of groundfish in the laboratory followed by experiments in the field using TV
Phase 1: and/or divers.

Phase 2:

Fish Behavior - 4

Sheet No. 2 File No.:

Method of Procedure: (Cont'd)

Phase 3:

Estimated Costs: Total Needed by Laboratory for Complete Project 110.4

	FY 1959	FY 1960	FY 1961
Personal Services	--	--	1.9
Other Expenses:			
Within Project	--	--	0.3
Lab. Adm. & Ser.	--	--	5.8
Lab. Total	--	--	8.0
Regional Office			.08
Washington Office			
Total			

Recommended Source of Funds S-K and Regular
(S-K, Regular, Contributed, etc.)

Estimated Date of Completion: Phase 1 FY 61 ; Phase 2 FY ; Phase 3 FY ; Project FY 65

Recommended by:

		Date
Originator	R. L. Livingston, Jr.	8/6/59
Investigation Chief	Robert Livingstone, Jr.	8/6/59
Laboratory Director	Herbert W. Graham	8/6/59
Regional Director	Joseph H. Blunchar	8/19/59
Branch Chief	[illegible]	12-24-59

Approved by:

Division Chief for Director [illegible]

Remarks

(Continue on reverse side)

#715 7/9/59

U. S. Fish and Wildlife Service
Bureau of Commercial Fisheries

Sheet No. 1

Location: Woods Hole, Mass.
Date: August 6, 1959
File No.

Research Project Outline

Title of Project: Diurnal Migrations of: (scup, butterfish, hakes)

Investigation Title: Fish Behavior

Investigation Chief: R. Livingstone, Jr.

Project Leader: R. Livingston, Jr. Fishery Research Biologist GS-9
Name Title Grade

Assistants: (Title and Grade)

Collaborators:

Need for Information: Commercial fishermen have learned to adjust their fishing to habits in accord with the diurnal changes in availability of fish. Fishery biologists know little about the mechanism of diurnal behavior in fishes. A study of the factors involved would be of great us to the New England fishing industry which is currently interested in the possibility of midwater fisheries.

Objective: To investigate the factors governing the diurnal behavior of scup, etc.

Method of Procedure:

Phase 1: To observe by means of remote UTV the behavior of scup, etc., in an enclosure at intervals over a 24 hour period. Record changes in orientation and behavior (currents, rate of swimming, feeding behavior, schooling, etc.)

Phase 2: Attempt a similar series of observations on a larger scale in the field using echo sounding, TV and mid water trawls.

Fish Behavior - 5

Sheet No. 2 File No.:

Method of Procedure: (Cont'd)

Phase 3:

Estimated Costs: Total Needed by Laboratory for Complete Project 30.7

	FY 1959	FY 1960	FY 1961
Personal Services	--	--	2.0
Other Expenses:			
Within Project	--	--	0.4
Lab. Adm. & Ser.	--	--	5.7
Lab. Total	--	--	8.1
Regional Office			.081
Washington Office			
Total			

Recommended Source of Funds S-K and Regular
(S-K, Regular, Contributed, etc.)

Estimated Date of Completion: Phase 1 FY 61; Phase 2 FY ; Phase 3 FY ; Project FY 63

Recommended by:

		Date
Originator	R. L. Livingstone, Jr.	8/6/59
Investigation Chief	Robert Livingstone, Jr.	8/6/59
Laboratory Director	Herbert W. Graham	8/6/59
Regional Director	Joseph T. Penneather	8/19/59
Branch Chief	[illegible]	12-24-57

Approved by:

Division Chief for Director [illegible]

Remarks

(Continue on reverse side)

#715 7/9/59

U. S. Fish and Wildlife Service
Bureau of Commercial Fisheries

Sheet No. 1

Location: Woods Hole, Mass.
Date: August 6, 1959
File No.

Research Project Outline

Title of Project: Experimental apparatus for testing swimming speed for haddock and other groundfish.

Investigation Title: Fish Behavior

Investigation Chief: R. Livingstone, Jr.

Project Leader: R. Livingstone, Jr. Fishery Research Biologist GS-9
Name Title Grade

Assistants: (Title and Grade)

Collaborators:

Need for Information: Research with television in trawl nets has shown that the speed of the net over the bottom has a pronounced effect on the resultant activities of fish in the cod end. Facilities for holding groundfish and for testing their swimming abilities must be devised before a quantitative appraisal can be made of the effect of towing speed on mechanism of escapement.

Objective: To develop apparatus for measuring swimming speed of groundfish.

Method of Procedure:
Phase 1: Design and test experimental apparatus in laboratory or field such as fish wheel, flume, TV rheotaxis cage, etc. Test fish of various sizes and observe their reactions to experimental apparatus.

Phase 2:

~~FOOD~~ BEHAVIOR - 6

Sheet No. 2 File No.:

Method of Procedure: (Cont'd)

Phase 3:

Estimated Costs: Total Needed by Laboratory for Complete Project 30.4

	FY 1959	FY 1960	FY 1961
Personal Services			1.9
Other Expenses:			
Within Project			0.3
Lab. Adm. & Ser.			5.8
Lab. Total			8.0
Regional Office			.08
Washington Office			
Total			

Recommended Source of Funds **S-K and Regular**
(S-K, Regular, Contributed, etc.)

Estimated Date of Completion: Phase 1 FY 61; Phase 2 FY ; Phase 3 FY ; Project FY 63

Recommended by:

		Date
Originator	**Robert Livingstone, Jr.**	8/6/59
Investigation Chief	Robert Livingstone, Jr.	8/6/59
Laboratory Director	Herbert W. Graham	8/6/59
Regional Director	Joseph F. Rinaldo	8/19/59
Branch Chief	[illegible]	12-24-59

Approved by:

Division Chief for Director [illegible]

Remarks

(Continue on reverse side)

#715 7/9/59